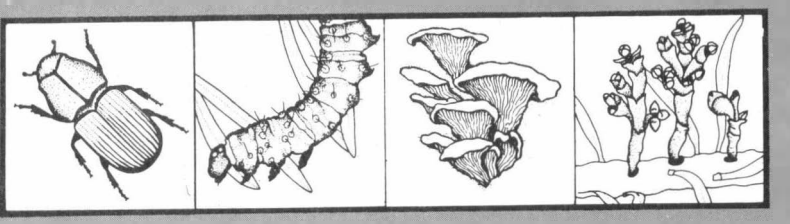
Forest Pest Management



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DISTRIBUTION OF THE BALSAM WOOLLY ADELGID IN IDAHO

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INTRODUCTION

The balsam woolly adelgid, *Adelges picea* (Ratzeburg), is a European insect that feeds on true firs (*Abies* spp.). Since its introduction into North America about 1900, it has spread throughout the eastern United States and Canada and in the west from California to British Columbia. Extensive acreages of true firs have been killed or damaged by the adelgid in these areas, including over 600,000 acres in Oregon and Washington from 1950-57 (Mitchell 1966).

In 1983, the balsam woolly adelgid was first detected in Idaho. It was found in Coeur d'Alene and at several sites east of Moscow (Livingston and Dewey 1983). Due to the potential damage this insect could cause in northern Rocky Mountain fir stands, we have monitored the population in Idaho since its discovery. This document reports our survey efforts through 1989.

BIOLOGY OF THE INSECT

The balsam woolly adelgid is a tiny sucking insect that feeds by inserting its long mouthparts into the inner bark of the main bole, branches, and twigs of true firs. There are five life stages--egg, 1st, 2nd, and 3rd instar nymphs, and adult. The adult is purple to black, nearly spherical, wingless, and less than 2 millimeters long. It produces a thick, white, wool-like material that completely covers itself. Reproduction is parthenogenetic (without mating and fertilization), and it only takes one insect to start a new infestation. The adult lays amber-colored eggs on the bark of its host trees under its woolly covering. The eggs hatch into "crawlers" or first instars which are the only active moving life stage. The crawler is dispersed by wind, birds, and animals. After selecting a feeding site, it inserts its mouthparts into the bark and transforms into a non-motile form. It remains anchored to one spot on the bark surface as it grows through two more instars and becomes a mature adult. The adelgid can have from two to four generations a year depending on elevation and temperature.

1/ Idaho Department of Lands, Coeur d'Alene

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DAMAGE

During feeding, the balsam woolly adelgid introduces a substance in the tree that causes abnormal growth of tree tissue. Infestations on limbs cause swelling or "gouting" of branch nodes and buds. Main bole infestations can cause the cambium to produce wide, irregular annual growth rings consisting of reddish, brittle wood similar to compression wood. Heavy attacks on the stem can result in tree death (Harris 1978). Light bole infestations appear as tiny flecks of white wool scattered on the bole. Heavy populations cause the entire bole to appear white. Early crown symptoms on infested trees are yellowing inner branches and poor growth. As adelgid populations increase on the tree, dying, bronze-colored branches appear randomly throughout the crown. Often, the lower crown dies leaving a greenish top. Sometimes the top dies first or the entire crown can die and turn red at once. Gouting is most visible on suppressed understory trees and young regeneration.

HOST SUSCEPTIBILITY

True firs vary in their susceptibility to balsam woolly adelgid attack. Of the two native true firs in Idaho, grand fir (*A. grandis* (Dougl.) Lindl.) and subalpine fir (*A. lasiocarpa* (Hook.) Nutt.), subalpine fir is the most susceptible.

Subalpine fir trees can be killed in 3-5 years by stem infestations. In Oregon and Washington, the most susceptible subalpine fir stands occur on stream bottoms, benches, and around meadows at low elevations (3,000-5,500 feet). High-elevation stands near timberline are rarely infested (Mitchell 1966). In Idaho, infestations were first found in subalpine fir growing in frost pockets at elevations less than 3,000 feet. However, in 1988 large populations of the balsam woolly adelgid were discovered in a number of high-elevation subalpine fir stands.

Grand fir is much more tolerant of the balsam woolly adelgid. In Oregon and Washington, trees can often endure infestations for 15 years. Growth loss and defect can be considerable, but less than 30 percent of infested trees die. Generally, the largest, most vigorous trees are most susceptible. Grand fir stands appear uniformly susceptible on the west side of the Cascades. Grand fir on the east side generally appears immune to the adelgid, even when intermingled with infested subalpine fir. Grand fir may become gouted, but the gouts disappear after the adelgids eliminate the susceptible subalpine fir (Mitchell 1966). In Idaho, adelgid populations have been found on grand fir adjacent to infested subalpine fir, and on a few isolated trees on a ridge top at 3,500-4,000 feet elevation. No adelgid-caused mortality has yet been observed on grand fir. Gouting is common on grand fir regeneration located near infested subalpine fir.

SURVEY METHODS

Annual ground surveys have been conducted in Idaho since the balsam woolly adelgid's discovery in 1983. Since much of the country surrounding the original infested sites is extensive grand fir and/or subalpine fir forest types, the surveys consisted of driving roads in the general area, stopping where host type was found and examining trees for evidence of the adelgid. When the adelgid was found, notes were recorded on the insect's relative abundance, tree mortality, and the host species. These surveys were limited by time and access. As new infested sites were found, the survey areas were expanded.

Aerial surveys are also conducted annually. Subalpine fir mortality as seen from the air is recorded on maps and where possible later checked from the ground. These surveys can only detect infestations that are heavy enough to cause tree mortality.

INFESTED AREAS

Five original sites were discovered in 1983 (Appendix A). For the next few years, new infested sites were found each year in the general infested area on the Palouse Ranger District, Clearwater National Forest, and adjacent State and private lands. These areas are characteristically isolated subalpine fir stands located in wet meadows and frost pockets at elevations less than 3,000 feet. No infestations were found at higher elevations at that time. In 1987, the adelgid was found near Headquarters, 20 miles southeast of any known infested area on open-grown grand fir located on a ridgetop. In 1988, three more sightings were reported near Pierce (45 miles from the original site) and Lowell (75 miles from the original site). Further examination of these areas produced several new infested sites, many of which were located in high-elevation (5,000-6,000 feet) subalpine fir stands. Subalpine fir mortality is extensive in many of these areas indicating the adelgid population has been there for at least 3 years as studies currently underway by Beckman have shown that trees can be killed within 3 years after the first insects are seen. In 1989, an intensive ground and aerial survey was conducted. Adelgid populations were found as far south as Elk City, Idaho Co., Idaho. Aerial observers reported approximately 40,000 acres of subalpine fir mortality caused by the balsam woolly adelgid. Most of the acres occured in Scofield Creek (T38N, R6E), Hemlock Butte (T36N, R7E), and Coolwater Ridge (T33N, R8E). Infested areas, as determined by ground surveys, are shown in Appendix A. Infestation levels range from very light to heavy in these areas. Legal descriptions with a local designation of all positive balsam woolly adelgid areas are listed below. The chart also shows the year of the find.

Year	Local Description		County	Discovering Agency
1983				
1.	T39N R1E Sec. 2	Round Meadows	Clearwater	IDL
2.	T39N R1E Sec. 4	Long Meadows Area	Latah	IDL
3.	T39N R1E Sec. 7	Long Meadows Area	Latah	IDL
4.	T39N R1E Sec. 8	Long Meadows Area	Latah	USFS
5.	T39N R1E Sec. 8	Long Meadow	Latah	IDL
6.	T40N R3W Sec. 36	Dry Creek	Latah	IDL
7.	T40N R1W Sec. 1	Potlatch River	Latah	IDL
8.	T40N R1W Sec. 11	West Fork Elk Creek	Latah	USFS
9.	T40N R1W Sec. 27	Potlatch River	Latah	IDL
10.	T40N R1W Sec. 27	Potlatch River	Latah	IDL
11.	T40N R1W Sec. 33	Potlatch River	Latah	USFS
12.	T40N R1W Sec. 33	Little Boulder Campground	Latah	IDL
13.	T40N R1W Sec. 34	Little Boulder Creek	Latah	IDL
14.	T40N R1E Sec. 7	East Fork Potlatch River	Latah	IDL
15.	T40N R1E Sec. 7	East Fork Potlatch River	Latah	USFS
16.	T40N R1E Sec. 18	East Fork Potlatch River	Latah	IDL
17.	T40N R1E Sec. 18	Ruby Creek	Latah	IDL
18.	T40N R1E Sec. 25	Cameron Creek	Clearwater	IDL
19.	T40N R2E Sec. 25	Partridge Creek	Clearwater	USFS
20.	T40N R2E Sec. 30	Cameron Creek	Clearwater	USFS

Year	Local Description		County	Discovering Agency
1983				
21.	T40N R2E Sec. 31	Cameron Creek	Clearwater	IDL
22.	T41N R1W Sec. 12	West Fork Potlatch River	Latah	IDL
23.	T41N R1E Sec. 25	East Fork Potlatch River	Clearwater	IDL
24.	T41N R1E Sec. 32	East Fork Potlatch River	Latah	IDL
25.	T41N R1E Sec. 33	East Fork Potlatch River	Latah	IDL
26.	T41N R1E Sec. 35	East Fork Potlatch River	Clearwater	IDL
27.	T41N R1E Sec. 35	East Fork Potlatch River	Clearwater	IDL
28.	T42N R1E Sec. 23	Highway 8	Shoshone	IDL
1984				
1.	T39N R1E Sec. 10	Long Creek	Clearwater	IDL
2.	T39N R1E Sec. 10	Long Creek	Clearwater	IDL
3.	T39N R1E Sec. 10	Long Creek	Clearwater	IDL
4.	T39N R1E Sec. 11	Tired Wolf Creek	Clearwater	IDL
5.	T39N R1E Sec. 28	Three Bear Creek	Latah	IDL
6.	T39N R1E Sec. 28	Three Bear Creek	Latah	USFS
7.	T42N R1E Sec. 3	Emerald Creek	Shoshone	IDL
8.	T42N R1E Sec. 3	Emerald Creek	Shoshone	IDL
9.	T43N R1E Sec. 6	Fernwood	Benewah	USFS
10.	T43N R1E Sec. 8	St. Maries River	Benewah	IDL
11.	T44N R1W Sec. 5	Soldier Creek	Benewah	USFS
1985				
1.	T42N R2W Sec. 25	Graves Meadow	Latah	IDL
2.	T42N R2W Sec. 26	Graves Meadow	Latah	IDL
3.	T44N R3W Sec. 13	John's Creek	Benewah	IDL
1986				
1.	T40N R3E Sec. 20	Partridge Creek	Clearwater	USFS
2.	T42N R1E Sec. 13	St. Maries River	Shoshone	USFS

Year	Local Description		County	Discovering Agency
1987				
1.	T38N R4E Sec. 34	Gold Creek	Clearwater	Potlatch Corp.
2.	T38N R4E Sec. 35	Ruby Creek	Clearwater	Potlatch Corp.
3.	T39N R1E Sec. 12	Oviatt Creek	Clearwater	USFS
4.	T39N R1E Sec. 21	Three Bear Creek	Latah	USFS
5.	T39N R1E Sec. 22	Three Bear Creek	Clearwater	USFS
6.	T40N R2E Sec. 14	Elk Creek	Clearwater	USFS
7.	T40N R3E Sec. 20	Partridge Creek	Clearwater	USFS
8.	T40N R3E Sec. 21	Partridge Creek	Clearwater	USFS
9.	T41N R1E Sec. 6	Potlatch River	Latah	USFS
10.	T41N R1E Sec. 7	Potlatch River	Latah	USFS
11.	T41N R1E Sec. 36	Bloom Meadows	Clearwater	USFS
12.	T41N R2E Sec. 26	Elk Creek	Clearwater	USFS
13.	T42N R1E Sec. 10	Emerald Creek Campground	Shoshone	IDL
14.	T42N R1E Sec. 22	Wood Creek	Shoshone	USFS
15.	T42N R1E Sec. 23	Highway 8	Shoshone	USFS
16.	T42N R1E Sec. 27	Keeler Creek	Shoshone	USFS
17.	T43N R2W Sec. 4	Hume Creek	Benewah	IDL
18.	T43N R2W Sec. 4	Hume Creek	Benewah	IDL
19.	T43N R2W Sec. 11	Charlie Creek	Benewah	IDL
20.	T43N R1E Sec. 22	Emerald Creek	Shoshone	IDL
21.	T43N R1E Sec. 27	Emerald Creek	Shoshone	IDL
1988				
1.	T32N R7E Sec. 1	Coolwater Ridge	Idaho	USFS
2.	T32N R7E Sec. 2	Coolwater Ridge	Idaho	USFS
3.	T33N R8E Sec. 31	Andy's Hump	Idaho	USFS
4.	T33N R8E Sec. 32	Andy's Hump	Idaho	USFS
5.	T33N R8E Sec. 34	Fire Lake	Idaho	USFS
6.	T34N R6E Sec. 5	Nevada Creek	Idaho	USFS
7.	T35N R6E Sec. 32	Utah Creek	Idaho	USFS
8.	T36N R7E Sec. 18	Beaver Saddle	Idaho	USFS
9.	T36N R7E Sec. 18	Beaver Saddle	Idaho	IDL
10.	T36N R7E Sec. 19	Belle Creek	Idaho	IDL
11.	T39N R5E Sec. 14	Beaver Creek	Clearwater	USFS
12.	T39N R6E Sec. 32	Middleton Creek	Clearwater	Potlatch Corp.
13.	T40N R2E Sec. 33	Bull Run Creek	Clearwater	IDL/USFS
14.	T41N R3W Sec. 15	Flat Creek	Latah	IDL/USFS
15.	T41N R3W Sec. 16	Flat Creek	Latah	IDL/USFS
16.	T41 N R3W Sec. 27	Flat Creek	Latah	IDL/USFS
17.	T41N R3W Sec. 28	Flat Creek	Latah	IDL/USFS
18.	T41N R2E Sec. 24	Upper Basin - Elk Creek	Clearwater	IDL/USFS
19.	T42N R2W Sec. 22	Poorman Creek	Latah	IDL/USFS
20.	T42N R1E Sec. 31	Porcupine Creek	Latah	IDL/USFS

Year	Local Description		County	Discovering Agency
1989				
1.	T29N R8E Sec. 23	Elk City	Idaho	USFS
2.	T30N R8E Sec. 33	Ericson Ridge	Idaho	USFS
3.	T30N R8E Sec. 18	Table Meadows	Idaho	USFS
4.	T30N R7E Sec. 2	Iron Mountain	Idaho	USFS
5.	T30N R7E Sec. 12	East Fork O'Hara Creek	Idaho	USFS
6.	T30N R7E Sec. 14	Ericson Ridge	Idaho	USFS
7.	T31N R6E Sec. 12	Lookout Butte	Idaho	USFS
8.	T31N R7E Sec. 22	West Fork Point	Idaho	USFS
9.	T31N R7E Sec. 30	Rackliff Creek	Idaho	USFS
10.	T31N R8E Sec. 26	Buck Meadows	Idaho	USFS
11.	T31N R8E Sec. 26	Buck Meadows	Idaho	USFS
12.	T31N R8E Sec. 35	Limber Luke Creek	Idaho	USFS
13.	T31N R9E Sec. 21	Falls Creek	Idaho	USFS
14.	T31N R9E Sec. 30	Horse Creek	Idaho	USFS
15.	T31N R10E Sec. 19	Squirrel Creek	Idaho	USFS
16.	T32N R8E Sec. 5	Rackliff Creek	Idaho	USFS
17.	T32N R8E Sec. 11	Boyd Creek	Idaho	USFS
18.	T33N R3W Sec. 8	Webb Creek	Latah	IDL
19.	T33N R3W Sec. 10	Mission Creek	Latah	IDL
20.	T33N R3W Sec. 11	Mission Creek	Latah	IDL
21.	T34N R7E Sec. 30	Walde Mountain	Idaho	USFS
22.	T34N R6E. Sec.7	Lolo Creek Campgrounds	Clearwater	USFS
23.	T35N R7E Sec. 5	Yoosa Creek	Idaho	USFS
24.	T35N R7E Sec. 20	Lolo Trail	Idaho	USFS
25.	T36N R9E Sec. 30	Burn Creek	Idaho	USFS
26.	T36N R9E Sec. 31	Sherman Saddle	Idaho	USFS
27.	T36N R9E Sec. 34	Sherman Pk.	Idaho	USFS
28.	T36N R7E Sec. 7	Hemlock Butte	Clearwater	IDL/USFS
29.	T36N R7E Sec. 17	Beaver Saddle	Idaho	IDL/USFS
30.	T36N R6E Sec. 2	French Saddle	Clearwater	IDL/USFS
31.	T37N R7E Sec. 27	Sylvan Saddle	Clearwater	USFS
32.	T37N R5E Sec. 5	Quartz Creek	Clearwater	IDL/USFS
33.	T37N R5E Sec. 9	Hollywood Campground	Clearwater	IDL/USFS
34.	T37N R5E Sec. 16	Trail Creek	Clearwater	IDL/USFS
35.	T38N R6E Sec. 2	Moose Creek	Clearwater	IDL/USFS
36.	T38N R6E Sec. 3	Scofield Creek	Clearwater	IDL/USFS
37.	T38N R6E Sec. 4	Scofield Creek	Clearwater	IDL/USFS
38.	T38N R6E Sec. 5	Scofield Creek	Clearwater	IDL/USFS
39.	T38N R6E Sec. 6	Deer Creek	Clearwater	IDL/USFS
40.	T38N R6E Sec. 6	Deer Creek	Clearwater	IDL/USFS
41.	T38N R6E Sec. 15	Washington Creek	Clearwater	IDL/USFS
42.	T38N R6E Sec. 16	Washington Creek	Clearwater	IDL/USFS
43.	T38N R6E Sec. 17	Washington Creek	Clearwater	IDL/USFS
44.	T39N R10E Sec. 18	Kelly Forks	Clearwater	USFS
45.	T39N R9E Sec. 6	Mush Saddle	Clearwater	USFS

Year	Local Description		County	Discovering Agency
46.	T39N R9E Sec. 14	Cold Springs	Clearwater	USFS
47.	T39N R7E Sec. 20	Tumble Creek	Clearwater	IDL/USFS
48.	T39N R7E Sec. 30	Old Camp	Clearwater	IDL/USFS
49.	T39N R6E Sec. 34	Rettig Creek	Clearwater	IDL/USFS
50.	T39N R6E Sec. 35	Otter Creek	Clearwater	IDL/USFS
51.	T39N R6E Sec. 36	Otter Creek	Clearwater	IDL/USFS
52.	T39N R5E Sec. 11	Beaver Creek	Clearwater	USFS
53.	T39N R5E Sec. 23	Beaver Creek Divide	Clearwater	USFS
54.	T39N R5E Sec. 27	Beaver Creek	Clearwater	USFS
55.	T39N R1E Sec. 29	Three Bear Creek	Latah	IDL
56.	T39N R1E Sec. 31	Three Bear Creek	Latah	USFS
57.	T39N R1E Sec. 31	Three Bear Creek	Latah	USFS
58.	T39N R2E Sec. 4	Bull Creek	Clearwater	IDL
59.	T40N R2W Sec. 1	Smith Meadows	Latah	IDL/USFS
60.	T40N R1 W Sec. 6	Tee Meadows	Latah	IDL/USFS
61.	T40N R1W Sec. 7	Smith Meadows	Latah	IDL/USFS
62.	T40N R1W Sec. 8	Tee Meadows	Latah	IDL/USFS
63.	T40N R1W Sec. 13	East Fork Ruby Creek	Latah	IDL
64.	T40N R1W Sec. 23	Potlatch River	Latah	IDL
65.	T40N R1W Sec. 28	Hog Meadow Creek	Latah	IDL/USFS
66.	T40N R1E Sec. 6	East Fork Potlatch River	Latah	USFS
67.	T40N R2E Sec. 28	Shattuck Creek	Clearwater	IDL
68.	T40N R2E Sec. 29	West Fork Lindley Creek	Clearwater	IDL
69.	T40N R3E Sec. 5	Elk Butte	Clearwater	IDL/USFS
70.	T40N R3E Sec. 6	Elk Butte	Clearwater	IDL/USFS
71.	T40N R3E Sec. 7	Pete Creek	Clearwater	IDL/USFS
72.	T41N R1W Sec. 2	Cougar Meadows	Latah	IDL/USFS
73.	T41N R2E Sec. 10	West Fork Elk Creek	Clearwater	IDL/USFS
74.	T41N R2E Sec. 11	Hemlock Butte	Latah	IDL/USFS
75.	T41N R2E Sec. 19	Mallory Creek	Clearwater	IDL/USFS
76.	T41N R2E Sec. 30	Badger Meadows	Clearwater	IDL/USFS
77.	T41N R3E Sec.7	West Fork Stony Creek	Clearwater	IDL/USFS
78.	T41N R3E Sec. 8	West Fork Stony Creek	Clearwater	IDL/USFS
79.	T41N R3E Sec. 21	Stony Creek Meadows	Clearwater	IDL/USFS
80.	T41N R3E Sec. 30	Windy Pt.	Clearwater	IDL/USFS
81.	T41N R3E Sec. 31	Isabella Creek	Clearwater	IDL/USFS
82.	T42N R3W Sec. 15	Macumber Meadows	Latah	IDL/USFS
83.	T42N R3W Sec. 26	Big Creek	Latah	IDL/USFS
84.	T42N R2E Sec. 9	Middle Fork St. Maries River	Shoshone	USFS
85.	T43N R2W Sec. 5	Deep Creek	Latah	IDL

SUMMARY AND RECOMMENDATIONS

The balsam woolly adelgid population in Idaho is expanding geographically, as well as intensifying in place. Populations have been found many miles from the original detection sites. The adelgid has killed many subalpine fir in as little as 3 years after being infested. Grand fir is now infested, although no mortality has yet been observed. From 1987 to 1988, the balsam woolly adelgid population increased dramatically on subalpine fir and grand fir with a significant increase in subalpine fir mortality. This increase in mortality was especially noted in high-elevation subalpine fir stands. The mild winters and dry summers of 1986 and 1987 have probably contributed to this increase (Mitchell, personal communication).

There is concern that the balsam woolly adelgid may impact grand fir, an important timber species in Idaho. There also may be adverse effects on watershed, wildlife, and recreation if subalpine fir mortality increases in high-elevation areas.

We recommend continued monitoring of the adelgid with emphasis on the insect's activity on grand fir. A more intense survey is also needed in high-elevation subalpine fir sites to determine extent of the adelgid population and tree mortality in these areas.

We encourage foresters and forest visitors to continue watching for this insect and to report suspected sightings to Timber, Cooperative Forestry and Pest Management, USDA Forest Service, Missoula, Montana; or Idaho Department of Lands, Insect and Disease Section, Coeur d'Alene, Idaho.

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PERSONAL COMMUNICATIONS

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Appendix A

Areas infested with balsam woolly adelgids as determined by ground surveys.

● Original infested sites discovered in 1983.

▲ Areas discovered 1983-1989.